

Action Plans/Recommendations on various internal issues and future factors have been developed for review and discussion:

1. Strategic Technology Selection, Development, and Review.
 - Involves an extension of our current process and focuses on technologies which may go beyond the direct control of the program coordinator, long-term are longer term and involve total utilization of technical staff in technology evaluation, implementation and review.
2. Support of Science Education
 - Addresses the need to foster the development of quality science education programs to ensure an adequate pool of skilled workers that will meet future company needs.
3. Recruiting
 - Discusses our current position with regard to recruiting and suggests additional strategies which may change the process to one that is more opportunistic rather than reactive.
4. Training
 - Outlines a number of key areas which will increase the awareness of the R&D staff (cross-functional training) and enhance the consistency of the work product (data analysis) and effectiveness of the management of the work processes (project planning).
5. Facility Plan
 - Head count projections, organizational changes, as well as the implementation of new technologies and workplace regulations will necessitate changes to R&D facilities. A facility plan is under development and progress is summarized.

STRATEGIC TECHNOLOGY SELECTION, DEVELOPMENT, AND REVIEW

The Strategic Technology List (Appendix E) is intended as an aid to the selection and development of technologies in support of our major programs. Since R&D resources cannot support all of these items, decisions between them must be made. Feasibility, timeliness and

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resource availability must be considered. By and large, this function is handled efficiently by the managers and program coordinators. Three areas where the process might be improved are:

1. The development of strategic science and technology items which require resources beyond the direct control of the program coordinator. These may require facilities or expertise from other programs, divisions or directorates or from external sources. Negotiation for work on such items is often delayed in cases where their development is necessary to the long-term objectives of the program, but not to the immediate goals.
2. The identification and utilization of existing R&D expertise for the evaluation of new science or technology areas.
3. The planning, initiation and review of basic research in support of long-term needs. In the face of specific immediate needs, it is difficult for a program coordinator or manager to justify the diversion of resources to basic investigations--no matter how promising these may seem in the long run. Thorough studies of the feasibility of timely contributions to program objectives are, themselves, resource consuming. Moreover, cost effective basic research may need to be structured to support several programs.

Action Plan: Strategic Science and Technology Identification, Development and Utilization.

To deal more efficiently with areas one and two, we recommend the establishment of an "R&D Technology Taskforce" This group would be chartered to:

- Obtain careful evaluations of the potential of selected areas of science or technology to contribute to R&D objectives.
- Promote the establishment of internal technology monitoring activities in the selected areas.
- Recommend appropriate development activities, which might range from evaluating commercial products to sponsoring external research or establishing an internal program.
- Provide continuing support for all activities initiated up to and including the implementation of developed technologies.

Areas to be evaluated would be selected in collaboration with the Managers and Program Coordinators. Unless requested by the Coordinators or Managers to do otherwise, the Task

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Force would confine its efforts to forward-looking technology evaluations and would not review the objectives or progress of ongoing programs.

The Task Force would consist of the Principal and Associate Principal Scientists and Engineers as well as additional members of the technical staff as required to ensure that the best internal expertise is applied to each area evaluated. Personnel from the programs involved would be included in all phases of the evaluation and recommendation process.

In reviewing a science or technology area, the Task Force would take full advantage of available literature and of internal expertise. Whenever possible members of the R&D staff would be asked to prepare and present summaries and recommendations. However the Task Force would be encouraged to use external consultants when necessary to make quality recommendations in a timely manner.

The preliminary recommendations of the Task Force would be discussed with the appropriate Managers and Program Coordinators before presentation to the Directors, Research Fellow and Vice Presidents. Final recommendations would be made at R&D Planning Meetings.

Action Plan: Program Review Process

The ability to explore new areas and concepts is a vital component of the R&D process which should not be unduly hampered. Thus the professional staff should be encouraged to pursue limited exploratory activities with a minimum of administrative detail. However, careful review of activities should occur on a regular basis. Thus it is recommended that formal review procedures be established for the initiation of new programs and for the continuation of existing programs.

For a new program or activity, the procedure would be initiated by the preparation of a proposal containing the following elements:

1. Review of the areas of science and/or technology involved.
2. Definition of objectives in terms of potential (a) business (product or process) contributions and/or (b) fundamental or applied knowledge of value to other programs.
3. Discussion of the technical approaches (tactics) to be employed to reach the above objectives. Major technical roadblocks should be identified and the probability of overcoming them assessed.

4. A review of existing internal and external expertise which might be applied to the program.
5. A projection of the resources required and the anticipated times to reach specified objectives.

Upon consideration and acceptance of the proposal, R&D management would obligate resources to it for a specified time period at the end of which the proposal and review process would be repeated. The proposal would be updated to include progress at PM and elsewhere and the acceptance criteria would include assessment of current resource and business needs. A specified time for the next review would be set and would be dependent on the nature of the program and the resources allocated for it.

It is recommended that R&D management and senior staff participate in the proposal/review process.

SUPPORTING SCIENCE EDUCATION

R&D's involvement in the areas of education and contributions should be part of the overall strategy for this plan period. The corporate philosophy and strategy for contributions will be addressed first. In a memorandum from Mr. Hamish Maxwell to Mr. Jack Nelson, dated February 2, 1990, a new initiative was developed to address issues surrounding the corporate contributions program. The highlights of this new initiative can be summarized into one of Focused Giving. Focused Giving was established to encompass three themes:

1. Education with special focus on the preparedness of the future work force;
2. Hunger and nutrition; and
3. Culture.

A portion of the total budget will be set aside for Focused Giving grants. It is readily apparent that all of R&D's contributions should be centered on the first theme; i.e., education with special focus on preparedness of the future work force. In global terms, the future work force could be members of our current staff, students at the college and post graduate level who are likely candidates to join us in the near future, and students below college level that will serve as the feeder group for higher education.

This department has had sustained contributions for the Virginia Academy and Junior Academy of Science and Project SEED of the American Chemical Society. Both of these programs have benefitted the high school students. Most recently we have embarked upon

graduate fellowships in chemistry at UVa and a graduate fellowship in physics at VPI. The purpose of these two fellowships was to establish a firmer relationship between R&D scientists and these two institutions of higher learning within the Commonwealth. Most other R&D contributions are focused toward a desired goal. In the cases previously cited, donations of money made through Corporate Contributions is to sustain activities in science and mathematics.

In addition to money, we contribute limited internal resources to such activities as conducting laboratory tours or presentations in the lecture hall. It is difficult to measure the worth of such tours. Mentor-student relationships with summer students may be a more effective means for increasing the future pool of employees for R&D. On previous occasions members of the department have conducted advanced chemistry classes for teachers in the Richmond Public schools. There are probably other efforts which have been directed toward contributions or in-kind services in the past, but we have never really established a concerted program for such activities. R&D shared devoting a certain portion of scientists' time in using their talents to assist in instruction of teachers and/or students at the high school, middle school and elementary school level in the Richmond community. Part of the focus of R&D ought to be in the "adopt a school programs". We have been responsible in honoring requests for R&D employees to visit schools to talk about scientific careers, but we need to be more overt in making our presence know in the science and math class rooms in the Richmond area. It would be beneficial to provide Summer Fellowships to outstanding local teachers to work in the R&D laboratories to update knowledge as well as augment their salaries. It should be clearly understood that these positions would not lead to full-time R&D employment. Hiring teachers in the local community to work full time in the laboratory would be detrimental to science education.

It is difficult to separate education support from contributions. In one case we are contributing time and talent toward enhancement of education whereas in other case we are using education as the vehicle to enhance contributions at the corporate level. We must continue to broaden the scientific education of our current staff through the judicious use of tuition refund, sabbaticals, and management directed scientific pursuits. In the latter context, an example involves the work of Gordon Bokelman on Cell Wall Research following R&D's management's decision to send him to Colorado State for such training. Part of our strategy for education for the current work force would be that every member of the department, regardless of status, be encouraged to attend at least one course of learning each year they are employed. This would require more rigorous involvement between R&D administration and the local and state school boards to facilitate such strength. Some of which could even be conducted on site. For example, through the advances in telecommunication, several advanced science and mathematics instruction can be conducted in our conference rooms and/or lecture hall. We have worked with Dr. Thomas Haas at VCU on master's degree programs in engineering.

The essential thrust of this program ought to result in a more overt effort to alleviate some of the existing problems which are currently plaguing science and math education in this

country. Although individual staff members are contributing to their local communities, this department needs to become more visible in local and state scientific activities. Any effort expended by members of the staff in enhancement of science education will certainly result in longer delays in completion of the focused goals of the department. However, this time devoted to establishing the bridge between our department and local and state authorities is and/or should be part of R&D's charter. Without a commitment on the part of senior management, the individual staff members are probably not going to be as effective as they could or should in this worthwhile pursuit. Most major corporations in this country, at this point in time, have developed rigorous programs in their satellite operations in various cities in this country. It is almost impossible to pick up a scientific magazine currently without some mention of what the corporation is doing or has done to ameliorate the problems dealing with increased interest in math and science in their local communities. There are numerous programs available at the national level in almost every scientific society that we could or should be using to sustain our commitment to science and education.

We have a Continuing Fellowship Committee for sabbaticals, a Technology Assessment Group, and a Technical Seminar Committee in the department. It seems appropriate within the confines of the Strategic Plan that we establish a committee on contributions and education for the department whose responsibility would be to establish a coherent program of what Philip Morris USA R&D ought to be doing to enhance the quality of education. There are numerous role model companies such as Dow, Amoco, and General Electric that would be worth on site discussions with our appointed committee. We must recognize that to do this job properly it is going to be a sustained effort which reaches far beyond the Five-Year Strategic Plan period of time. Although some of our current efforts are worthy of our sustained interest and commitment, it would be ill advised to spend a large amount of time and energy in a one to two-year commitment at the local level to satisfy this need. We must make the commitment to use our internal resources of personnel time and budgeted monies to address this concern.

RECURRING

Hiring in R&D (at the professional level) is almost exclusively reactive; that is, we lose a person and then we generate specifications to replace them. We then utilize the Employment Department to generate ads, utilize agencies and to follow up on leads given to them by the hiring management. There is no "hiring plan" to bring in a number of entry level persons on a regular basis. For the past 2-3 years, we have utilized Summer Intern positions as a means for keeping campus contacts for entry level persons. We have designated that all of these positions be filled with minority candidates. We have tried to utilize departments in schools that we feel produce students that we would want to hire. The students we have gotten under this philosophy have been good and we have had some of the students return as they have gone on to pursue advanced degrees (no hires thus far). The overall objective has been to establish a relationship on campus so that when we needed entry level persons we would not be a "new face" on campus,

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but an established one. Then we could look to hire an intern or hope that the faculty could lead us to viable candidates. This would also mean that they might send candidates our way "out of the scheduled" time frame and we would want to respond positively to that also.

The same basic principles could be utilized for higher level personnel by:

- carefully targeting acceptable programs
- maintaining on-going contacts and providing work opportunities
- hiring a portion of the personnel
- stating up front a commitment to minorities/females
- involving R&D personnel in the management of this process

TRAINING

Cross-Functional Training: The internal situational analysis identified the need for increasing R&D employee's knowledge of tobacco processing and cigarette manufacturing operations. An existing program provides selected bench scientists with this knowledge through 4-6 month assignments in the Semiworks and Process Development Pilot Plants. Even though this program has been successful, it involves only two people per year and has a limited overall impact on R&D. A need exists for a short program aimed at providing general processing/manufacturing knowledge to a majority of the R&D professional staff. It is envisioned that this program would be an annual orientation involving a number of selected individuals. The orientation would include tours of all the different processing and manufacturing plants.

Data Analysis/Project Planning: A project conducted during the period May 15-August 15, 1990, by a Visiting Scientist (Dr. W. Wegscheider) involved a critical evaluation of the potential of alternate methods of data analysis to provide correlations between analytical chemical information and other data such as subjective evaluations. The basic approach utilized multivariate analysis concepts. Traditional methodologies such as statistical analysis and partial least squares (PLS) were employed. In addition, newer concepts such as fuzzy logic, neural networks and artificial intelligence were considered. Several past and/or on-going projects were reviewed as candidates for these approaches. Two factors important to the success of projects were found to be related to the following components important to project execution: project planning and expertise and promptness of data analysis. Recommendations include the enhancement of data analysis expertise and knowledge of data quality issues as well as the enhancement of project management skills involving planning and coordination. Standard operating procedures which outline accepted data analysis methods should be developed where needed and readily available project management training and supporting materials should be targeted to key R&D staff.

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FACILITY PLAN

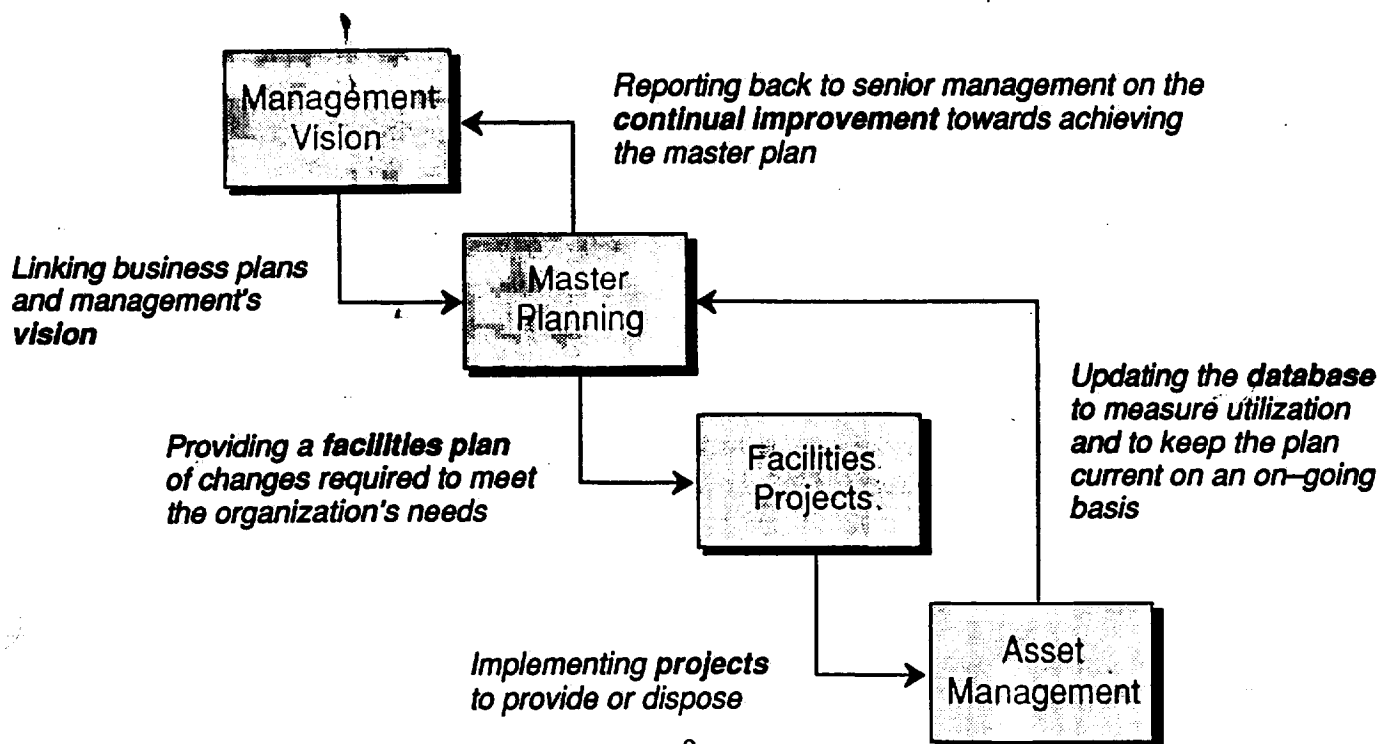
I. INTRODUCTION

Facility master planning is an ongoing process which requires management support, has realistic and feasible projects to implement and one that has a system in place with which to update and measure continual improvement towards achieving the department's and company's mission. A facility master plan is a tool for visualizing the future. It represents a future condition that is better than now exists. If the master plan is to be successful, it must be integrated and linked to the business plan of R&D, as well as the rest of the company. Table I illustrates the process of developing and maintaining a facility master plan.

TABLE I

INTEGRATED MASTER PLANNING PROCESS

Integrated Master Planning Process



II. FACTORS IMPACTING RESEARCH FACILITIES

According to Jim Richert, Director of R&D facility design at Hellmuth, Obata & Kassabaum, a St. Louis based international facilities consulting firm, "Researchers' facility needs already differ significantly from those twenty, ten or even a few years ago. Several trends signal that the relationships between researchers and their working environments are on the verge of extraordinary change."² In R&D we are experiencing the changes on a daily basis. The increasing cost, complexity and capability of technical instrumentation and the appropriate space and special environmental conditions required to house and maintain them is a constant challenge. Growing concerns about health threats to research personnel and environmental hazards have intensified in recent years as evidenced by the increased number of OSHA standards and guidelines including the most recently published "Chemical Hygiene Plan."³ Over the past five years, research space has been modified in an attempt to provide separate lab areas and work station/desk areas for research personnel. EPA regulations with regard to hazardous chemical disposal, asbestos abatement, waste management and other environmental concerns have continued to escalate in recent years.

Collaborative research programs involving multidisciplinary teams spanning the entire R&D organization have changed the approach for allocation of facility space. The requirement for space to implement new programs on an expedited basis has presented challenges, particularly in the last several years. Available space for special laboratories or pilot plant applications is at a premium. The last remaining area of "undeveloped real estate," the old D1 Semiworks/Primary has been totally cleared to accommodate Project Pack, the modified Smoking Materials Project and a "temporary" laboratory installation for small scale handsheet cast-leaf research. The remainder of space has tentatively been allocated for critical parts inventory and supplies storage for "C" Pilot Plant and the new Cast Sheet Pilot Plant. Laboratory and office space requirements for the personnel currently located on the soon-to-be-demolished C2 Balcony necessitate a major "squeeze play" in order to accommodate the needs. Consolidation of the Paper Program in the O/C, R&D laboratories and Beta project on D2 with concurrent moves of approximately fifty personnel has presented yet another new set of challenges. Several other groups including Analytical Research have specific space requirements which cannot currently be met due to space availability constraints. Space requirements to accommodate new production equipment at the Semiworks will provide challenges in the near future.

All of the factors noted above have signaled the need for a comprehensive review of the current and future requirements of the department with respect to its facilities and whether we will be able to accommodate the new program needs three to five years in the future.

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III. THE FACILITY PLAN

It is readily apparent that a proactive plan for the R&D facilities, and one that is closely linked and integrated with the R&D Strategic Plan, must be addressed and developed to move the Department into the future.

The Industrial Engineering Group was requested to assist R&D in developing a Master Facility Plan that would address current, short-term needs and forecast needs five to eight years into the future.

The project, as defined by the industrial engineers assigned to assist R&D, comprises four distinct phases as follows:

Phase I: Space and Program Requirements Analysis

A survey was conducted to collect basic quantifiable space and program needs information. The survey entails a review by major R&D functional area, of current versus forecasted employees, equipment, special laboratory or space needs and service requirements. Information gathered in this phase will serve as the data base from which space-related deficiencies may be addressed, or conversely, space availability opportunities exist to be exploited.

Status: All divisional surveys have been completed. Interviews with R&D managers were conducted in October. Analysis of manager input from the survey results is underway.

Phase II: Develop Conceptual Long-Range Master Facility Plan

Based on results of the space needs analysis, the Industrial Engineers will collaborate with R&D staff to develop a set of feasible overall space utilization alternatives for each of the major R&D buildings, which will achieve the identified long-range research program needs of the Department. Although the major focus of the study is the R&D North Complex, (i.e., the facilities north of Bells Road), assessment is also required of space occupied by R&D staff at the Operations Center and Semiworks to ensure optimal space utilization for the total R&D mission.

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III. THE FACILITY PLAN (Continued)

Phase III: Develop Solutions for Short-Term Space Needs

Using the Master Facility Plan as a road map, the Industrial Engineers will then address specific requests by R&D staff to develop solutions for identified short-term space issues. These include the following:

A. "D" Pilot Plant

Develop a plan for improved design and space utilization of "D" Pilot Plant.

B. North Complex

Address current cubicle versus office availability and laboratory space utilization with special emphasis on needs for the Analytical Research Division.

C. "E" Building

Address logistical problems associated with the Product Evaluation Division's POL mailout operation, including the feasibility of off-site relocation. (This study is well underway by the Industrial Engineering Department.)

D. R&D Semiworks

A study is currently underway to examine the feasibility of relocating the Competitive Testing mailout operation to another off-site location in order to free up space for other critical needs of the semiworks operation.

Phase IV: Project Engineering Assistance/Implementation

Recommendations identified in the study may require the involvement of Project Engineering to spearhead cost estimating, funding and implementation management. Projects which have been tentatively identified for further analysis include areas in D1 North, "D" Pilot Plant and North Complex laboratory/office areas. It is too early to speculate as to what may be specifically required in the way of renovation and construction to meet the near-term (three to five years) and longer-term (five to eight years) needs of the Department.

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Once established, the Master Facility Plan will provide a valuable tool for a more proactive approach for management of the R&D facilities in the future.

References:

1. Parshall, Steven A. et. al, "Beyond the Year 2000...Facility Master Plans Envision the Future," *International Facility Management Association Journal*, October 1989, pp. 8-23.
2. *Federal Register*, Vol 55, No. 21, January 31, 1990, pp. 3300-3335; 29 CFR Part 1910 Subpart Z.
3. Richert, Jim, "Designing for the Future of R&D - Redefining the Laboratory Work Environment," presented at the International Facility Management Association R&D Council Spring Meeting, Pittsburgh, PA, June 1990.

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